

C-130 IMPEX / INTEX-B Flight Summary

date: 11 May 2006 (20060511)

flight number: 11

Take-off: 16:34:50 GMT

Landing: 00:20:08 GMT

Objectives:

- sample low altitude Asian inflow over both land and water along the coast
- spiral under two OMI and one SCIAMACHY overpass
- test Asian pollution location and intensity in the models

Instrument status:

All instruments, except SABL, RO₂ in 4-channel CIMS, FODIRS, and TOGA, were operating.

Flight summary.

The flight track was somewhat cloudier than anticipated along the northern end, but were either sparse or gone on the southwestern portions of the flight tracks. Polluted layers were interspersed with cleaner air, often quite clean, with CO less than 90 ppbv, O₃ less than 60 ppbv, and CN and aerosol scattering also very low. For most of the flight, the pollution layers were only a few thousand feet thick and were less intense than those observed on previous flights. Over the ocean, they were typically observed in the range of 2 to 6 kft ($\theta \sim 289$ -297 K) and 11 to 15 kft ($\theta \sim 300 - 305$ K). In these layers, CO (~150-180 ppbv), O₃ (~50-80 ppbv), NO_y (~1 ppbv), and moderate levels of particles were among the pollutants that were observed.

Coming in from the ocean over the California coast below 6 kft, the potential temperature surfaces sloped down into the ocean and land. A thin pollution layer (thickness ~ 1 kft, $\theta=291$ K) that was first observed over the ocean at ~3 kft, and was followed downward and into the coast, where its shape became less well defined. It seemed to merge with other pollution. This portion of the flight path may be useful for studying the entrainment of pollution into the boundary layer.

As the C-130 ascended, a pollution layer was encountered at 5.5 kft, with $\theta = 303$ K. Over the ocean, a pollution layer was observed at about this potential temperature at ~12 kft over the ocean. Are these two layers the same layer that has descended over land?

The C-130 then began a spiral down at 17.5 kft over the Central Valley, just north of the position of previous spirals. The air above the boundary layer was clean, but the PBL, which rose to ~3.5 kft, was quite polluted and hazy, with CO ~ 180 ppbv, NO_y ~ 4 ppbv, PAN ~ 0.6, and high levels of CN and aerosol scattering.

Rising over the mountains to the north of the Central Valley, the C-130 encountered air from 1500 ft above ground level (AGL), which was typically 6-8 kft, up to about 12 kft that had a constant potential temperature of 302-303 K. The air in this constant potential temperature layer oscillated between clean and polluted over a few minutes. This portion of the flight may be a good study of the mixing of polluted and clean air masses.

The legs over the Oregon coast to and from the ocean were fairly clean at all altitudes. This clean air was not expected from the models that had forecasted low-altitude pollution along these flight legs. The air remained fairly clean most of the way back to Seattle.

About 150 km south of Paine Field, a thick pollution layer was encountered. It extended from 12 kft, where it was fairly weak, to at least 17.5 kft, and probably even higher. The pollution at 17.5 kft was some of the greatest that was observed during the flight, with CO \sim 210 ppbv, NO_y \sim 1.2 ppbv, and significant aerosol scattering.

Overall summary. The flight's objectives were met. Pollution layers, albeit at times not with the predicted strength or positions and most likely from Asia, were encountered over much of the flight track. It is possible that entrainment and mixing of air masses were both observed, although careful analyses will be needed to find out. The OMI / SCIAMACHY comparison, under essentially cloudless skies, appears to have been successful. The apparent differences in position and intensity between the observed and forecast pollution layers provide a good test of the models.